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PATENT SPECIFICATION

693,096

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COMPLETE SPECIFICATION

Improvements in Devices for Catalytically Recombining Evolved Gases in Electric Accumulators

We, INDUSTRIAL RESEARCH, INC., a corporation organised under the laws of the State of Florida, United States of America, of 4016 N.W. 29th Street, Miami, Florida, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a battery cap apparatus or unit which is adapted for attachment to an electric storage battery.

The present invention provides a catalytic battery cap unit adapted to be attached to a cell of an electric storage battery for recombining the hydrogen and and oxygen gases escaping from the battery, to form water to be returned to the electrolyte of the battery, comprising a housing having a threaded lower attaching stem portion adapted to be detachably connected to an inlet opening in the top wall of an electric storage battery, and characterized by a catalyst cartridge arranged in the said housing and including a porous catalyst carrier mass coated with a water-resistant but gas-permeable coating, and a catalyst mass arranged in and surrounded by the porous coated catalyst carrier for recombining the hydrogen and oxygen gases which have evolved from the electrolyte to form water for return thereto.

It has been known heretofore that the hydrogen and oxygen gases evolved from electric storage batteries may be catalytically recombined to form water which may be returned to the electrolyte of the storage battery so as to maintain the level of the electrolyte substantially constant for a prolonged period of time and without the addition of other water thereto.

However, heretofore in the art certain problems have arisen in the use of such catalytic battery cap apparatus for a number of reasons and among those are the following: (a) the catalytic reaction involving the recombining of hydrogen and oxygen to form water is highly exothermic and somewhat difficult to control; (b) the catalyst tends to become poisoned by stibine gas, acid vapors, and other materials which escape as vapors from the storage battery; and (c) the catalyst and the catalyst carrier tend to become wet with water formed by the recombining of the hydrogen and oxygen gases evolved from the electric storage battery with the result that the catalyst suffers a marked loss of efficiency.

It is essential in the use of such catalytic battery cap apparatus that the catalyst carrier be porous and gas permeable so that the hydrogen and oxygen gases which escape from the electric storage battery may contact the surface of the catalyst where the recombining of the hydrogen and oxygen gases from the electric storage battery takes place and any poisoning or wetting of the contact surface of the catalyst, as well as wetting of the catalyst carrier, causes a marked decrease in the efficiency of the catalyst.

Accordingly, an object of the present invention is to provide a new and improved battery cap apparatus or unit which is adapted to be attached to an electric storage battery and which embodies means for catalytically recombining the hydrogen and oxygen gases escaping from the battery to form water which is returned to the electrolyte of the battery and which battery cap apparatus or unit is so designed and constructed that the catalyst embodied therein will not become poisoned by means of stibine gas, and vapors, or other catalyst poisons and will not become wet with water while, at the same time, the catalyst carrier will not become wet or loaded with water.

Another object of the invention is to provide a new and improved battery cap apparatus or unit which embodies a

[Price 2/8]

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porous catalyst carrier which is porous or gas permeable to the hydrogen and oxygen gases which escape from the battery so that these gases are recombined to form water which is returned to the electrolyte while, at the same time, the catalyst is resistant to the poisoning action of stibine gas, and vapors and other corrosive vapors which escape from the battery.

An additional object of the invention is to provide a new and improved battery cap apparatus or unit in which the catalytic action of the catalyst upon the hydrogen and oxygen gases which escape from the electrolyte is controlled so that it does not become too reactive and hence does not become violent.

A further object of the invention is to provide a new and improved battery cap apparatus or unit embodying a novel construction for supporting the catalyst carrier and the catalyst.

An additional object of the invention is to provide a new and improved catalytic battery cap apparatus embodying a housing having a novel vent for venting the interior thereof and for preventing the electrolyte in the battery cell to which the new battery cap apparatus is attached from rising to a point where it might attack the catalyst container or cartridge which is embodied in the new catalytic battery cap unit.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment of the present invention and the principles thereof and what we now consider to be the best mode in which we have contemplated applying these principles.

In the accompanying drawings:—

Fig. 1 is a side elevational view of a conventional three-cell electric storage battery showing three of the new catalytic battery cap units mounted therein;

Fig. 2 is an exploded view showing the parts of the new catalytic battery cap apparatus or unit;

Fig. 3 is a top plan view of the same;

Fig. 4 is a bottom plan view thereof;

Fig. 5 is a side elevational view of the new battery cap apparatus or unit, as assembled;

Fig. 6 is an enlarged central vertical sectional view of the new battery cap apparatus or unit;

Fig. 7 is a bottom plan view of the catalyst container or cartridge, a part of the bottom wall thereof being broken away to reveal the interior thereof;

Fig. 8 is a side elevational view of the catalyst container or cartridge; and

Fig. 9 is a transverse central vertical sectional view of the catalyst container or cartridge on line 9—9 in Fig. 7.

A preferred embodiment of the new catalytic battery cap apparatus or unit is illustrated in the drawings, wherein it is generally indicated at 10, and three of the new catalytic battery cap units are shown mounted upon a conventional three-cell electric storage battery 11 and which includes a hard rubber top wall 12 having three upwardly extending internally threaded inlet nipples 13 each of which opens at its lower end, as at 14, into one of the cells in the storage battery 11 (Fig. 6).

The new battery cap apparatus or unit 10 includes an attaching stem 15 having an externally threaded wall 16 which is adapted to be threaded into one of the internally threaded inlet nipples 13 of the battery 11 and having a vertical bore or passage 17 formed therein. The new battery cap apparatus or unit 10 also includes a generally cylindrical cup-shaped base which may be made of any suitable material such, for example, as porcelain of other ceramic material, synthetic resinous plastic materials or the like, and this generally cylindrical cup-shaped base 18 has an annular flange 19 formed thereon the the top thereof. The generally cylindrical cup-shaped base 18 also includes a tapered or inclined wall 20 which interconnects the body thereof and the annular flange 19. A vent opening 21 is provided in the wall of the generally cylindrical cup-shaped base 18 at the juncture of the inclined wall 20 and the annular flange 19 and this vent opening has an inclined upward extension 21 which projects upwardly into the interior of the cup-shaped base 18. The upward extension 22 of the vent opening 21 may be formed as a hollow integral upward extension of, or boss formed upon, the wall of the generally cylindrical cup-shaped base 18 or it may be formed as a separate part or tube adhesively attached to the wall of the generally cylindrical cup-shaped base 18 and, in either event, it projects into the interior of the body of the generally cylindrical cup-shaped base 18 above the well which is provided therein by the inclined wall 20 (Fig. 6).

The new battery cap apparatus or unit also embodies a cap or top member 23 which includes a relatively thick top wall 24 and an annular side wall 25 having a depending skirt portion 26 which extends downwardly into the interior of the annular flange 19 of the generally cylindrical cup-shaped base 18 and is secured thereto

in any suitable manner, as by means of a suitable adhesive 27 (Fig. 6).

The new battery cap apparatus or unit includes a supporting member in the form of a suitably formed nickel wire support 28 which is arranged within the cap 23 and is adapted to support the catalyst container or cartridge 31, as will be described presently. This supporting member 28 which includes a horizontally extending top portion 29 having depending supporting legs 30 formed integral therewith and which rest upon the generally cylindrical cup-shaped base 18 within the depending annular skirt 26 of the cap 23. A catalyst container or cartridge 31 is arranged upon the top wall 29 of the support 28 and this catalyst container or cartridge 31 includes a generally cylindrical foraminous and preferably nickel-coated screen-like housing 32 which includes a foraminous bottom closure wall 37 which is larger in diameter than the body 32 and thus provides an external annular attaching flange 33 at the bottom thereof. The catalyst container or cartridge 31 may be held in position in any suitable manner as by being adhesively secured to the inner surface of the vertical side wall 25 of the cap 23 by means of spots of a suitable adhesive 36 applied upon the attaching flange 33 (Fig. 6).

The catalyst container or cartridge 31 includes a catalyst carrier in the form of mass or body of porous material, such, for example, as fibrous asbestos 34, which is arranged in the foraminated or screen-like housing 32, and a catalyst mass in the form of catalyst pellets 35 which are arranged within and are surrounded by the mass or body of the catalyst carrier 34, the catalyst pellets 35 being preferably in the form of generally cylindrical activated platinum or palladium pellets.

In the practice of the present invention we have found that improved and unexpected efficiency in the use of the new battery cap unit has been obtained by coating the porous catalyst carrier mass 34 with a suitable water-resistant but gas-permeable coating and for this purpose we have found that the so-called silicone resin coatings are admirably suited since they may be applied effectively as a very thin coating on the fibres of the fibrous catalyst carrier 34 to render the latter resistant to moisture and water and catalyst poisons, such as stibine gas which escape from the electric storage battery 11, while, at the same time, the thus coated porous catalyst carrier 34 is gas permeable so that the hydrogen and oxygen gases which are evolved from the electric storage battery 11 may readily contact the external surfaces of the catalyst pellets 35 to be recombined thereupon into water. The water-resistant but gas-permeable coating may be applied to the fibers of the porous catalyst carrier 34 in any suitable manner before the catalyst pellets 35 are embedded therein.

Thus, in the practice of the present invention we have found that the mass of the porous catalyst carrier 34 may be suitably coated as follows: A suitable quantity of asbestos fiber is washed with water, (such washing with water may be omitted if the asbestos fiber is of suitable quality), filtered through a screen, partially dried in air, then washed with acetone and dried for from 8 to 24 hours at 150° C., with occasional stirring or, if desired, the fibrous asbestos may be dried at a higher temperature of 300° to 400° C. for a shorter period of about 4 hours, with occasional stirring, until complete drying which is essential, is assured. The thus completely dried asbestos fiber is then immediately rendered water-resistant and moisture-resistant but gas-permeable by mixing it with a 20 per cent solution of DC—200 silicone resin dissolved in carbon tetra-chloride (CCl_4), with stirring. The excess of the carbon tetrachloride may be removed from the thus coated asbestos fiber by air or oven drying, whereupon the thus coated asbestos fiber is heated at a temperature of from 300° to 325° C. in a muffle furnace, with occasional stirring, until it ceases to evolve white smoke vapors. The temperture range of 300° to 325° C is quite critical since the temperatures below 300° C. are inadequate to drive off all of the white smoke vapors which are evolved during this heating operation while temperatures above 325° C. tend to destroy the silicone resin coating. The finished product is then tested by a floating specimen thereof on water and is satisfactory if the specimen will float on water while, at the same time, the thus coated fibers remain dry and are not wet by the water.

The catalyst container or cartridge 31 may then be assembled by packing a mass of the coated asbestos fiber 34 tightly into the generally cylindrical body 32 of the foraminous or screen-like housing of the catalyst container or cartridge 31, placing a group of the catalyst pellets 35 in the asbestos fiber which has been packed into the body 32 of the foraminous or screen-like housing of the catalyst container or cartridge 31, covering the catalyst pellets 35 with the coated asbestos fiber 34, and then covering the mass of coated asbestos fiber 34 and catalyst pellets 35 with the screen 37, which provides the annular flange 33, and then securing the screen 37 to the generally

cylindrical-shaped screen 32 in any suitable manner, as by spot welding, crimping the edges of the screen 32 into the mesh of the screen 37, at selected points in the latter, or otherwise. The thus completed catalyst container or cartridge 31 may then be placed in the cap 23 (while the latter is in inverted position) and the supporting member 28 arranged therein and the catalyst container or cartridge 31 secured in position by means of the spots of adhesive 36 placed on the flange 33 and in contact with the inner surface of the side wall 25 of the cap 23.

In the use of the new catalytic battery cap unit the same may be readily attached in position of use on the battery 11 by screwing the externally threaded attaching stem 15—16 into the internally threaded nipple 13 of the battery 11 (from which the conventional closure cap has been removed) whereupon the hydrogen and oxygen gases which are evolved from the electrolyte of the battery cell will flow upwardly through the bore or passage 17 in the attaching stem 15—16, through the generally cylindrical cup-shaped base 18. into the cap 23, past the supporting member 28, through the foraminous housing 32—37, into and through the coated mass of asbestos fibers which provide the catalyst carrier 34 and thence into surface contact with the catalyst pellets 35 which thereupon catalytically recombine the hydrogen and oxygen gases to form drops of water which fall, by gravity, through the coated mass of asbestos fibers 34 and the foraminous or screen-like housing 32 into the generally cylindrical cup-shaped base 20, and thence through the passages 17 and 14 into the electrolyte in the battery cell to maintain the level of the electrolyte at the desired level, and to maintain the electrolyte in an efficient operating condition, for a prolonged period of time and without the necessity of adding extraneous water to the battery electrolyte.

It has been found in the use of the new catalytic battery cap apparatus or unit that the same will operate efficiently for a prolonged period of time to recombine the hydrogen and oxygen gases which escape from the electrolyte of a storage battery cell while also preventing the exothermic catalytic reaction from becoming too active or violent and, at the same time, preventing the porous catalyst carrier mass 34 and the catalyst pellets 35 from becoming water loaded and preventing the catalyst pellets 35 from becoming poisoned by stibine gas, acid vapours, or other impurities or corrosive materials escaping from the storage battery cell to which the new catalytic battery cap apparatus or unit is applied.

If the level of the battery electrolyte should, for any reason, rise to a point where it would flow into the new battery cap unit 10 the electrolyte will be retained in the generally cylindrical cup-shaped base 18 until it reaches the height of the overflow vent 22 whereupon it will flow out of the latter through the vent opening 21 to the atmosphere, thereby preventing the electrolyte from entering into and attacking the catalyst container or cartridge. 31.

It will thus be seen from the foregoing description, considered in conjunction with the accompanying drawings, that the present invention provides a new and improved battery cap apparatus or unit having the desirable features, advantages and characteristics and accomplishing its intended objects including those hereinbefore pointed out and others which are inherent in the invention.

What we claim is:—

1. A catalytic battery cap unit adapted to be attached to a cell of an electric storage battery for recombining the hydrogen and oxygen gases escaping from the battery, to form water to be returned to the electrolyte of the battery, comprising a housing having a threaded lower attaching stem portion adapted to be detachably connected to an inlet opening in the top wall of an electric storage battery, and characterized by a catalyst cartridge arranged in the said housing and including a porous catalyst carrier mass coated with a water-resistant but gas permeable coating, and a catalyst mass arranged in and surrounded by the porous coated catalyst carrier for recombining the hydrogen and oxygen gases which have evolved from the electrolyte to form water for return thereto.

2. A catalytic battery cap unit as claimed in Claim 1, characterized by the feature that said catalyst cartridge includes a foraminated container which is arranged in the said housing and which contains and encloses the said porous catalyst carrier and the said catalyst mass.

3. A catalytic battery cap unit as claimed in Claim 1, characterized by the feature that said catalyst cartridge includes a generally cylindrical container which contains and encloses the said catalyst carrier and the said catalyst mass.

4. A catalytic battery cap unit as claimed in Claim 1, characterized by the feature that said water-resistant but gas-permeable coating is in the form of a silicone resin coating and in which the

catalyst mass is the form of catalyst pellets of activated platinum or palladium.

5. A catalytic battery cap unit as claimed in Claim 1, characterized by the featur that said housing includes an attaching flange portion which is adhesively attached to the outer surface of said housing.

6. A catalytic battery cap unit as claimed in Claim 1, characterized by the feature that said housing has a vent opening formed in the wall thereof opening outwardly upon the outer surface of said housing and having an extension projecting interiorly and upwardly into said housing below the said catalyst cartridge and the said generally cylindrical foraminated container embodied therein.

7. A catalytic battery cap unit constructed substantially as herein described with reference to Figures 1 to 9 of the accompanying drawings.

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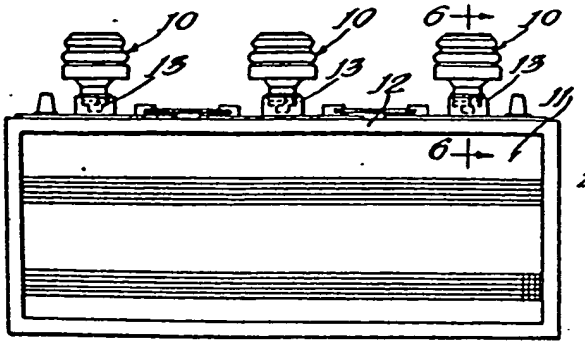
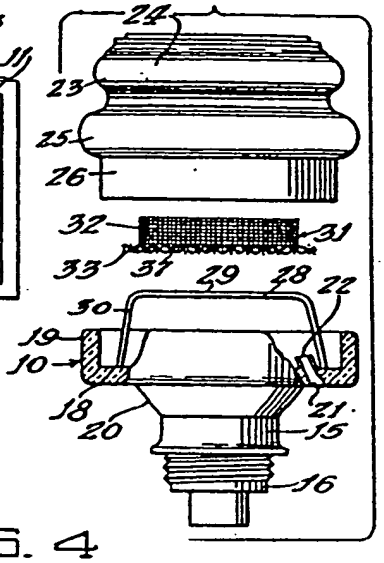


FIG. 1

FIG. 2



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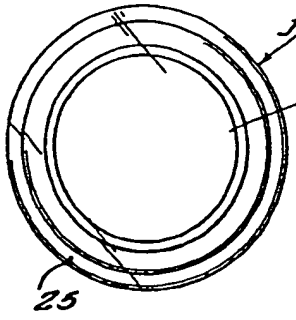

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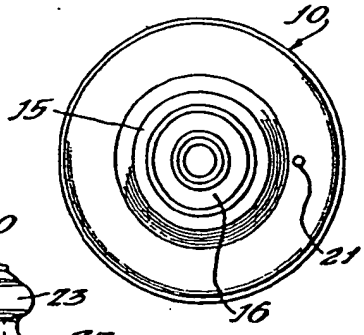
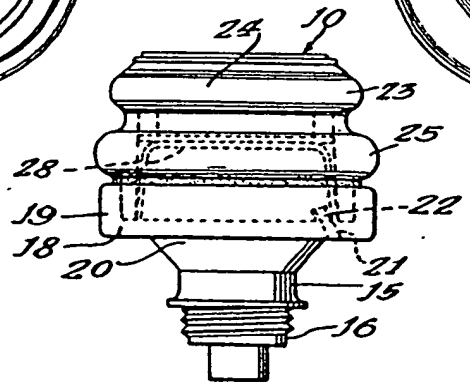


FIG. 5



693,096 COMPLETE SPECIFICATION

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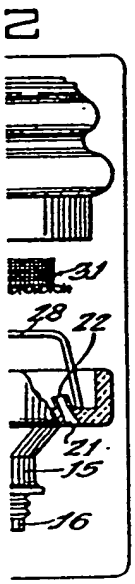

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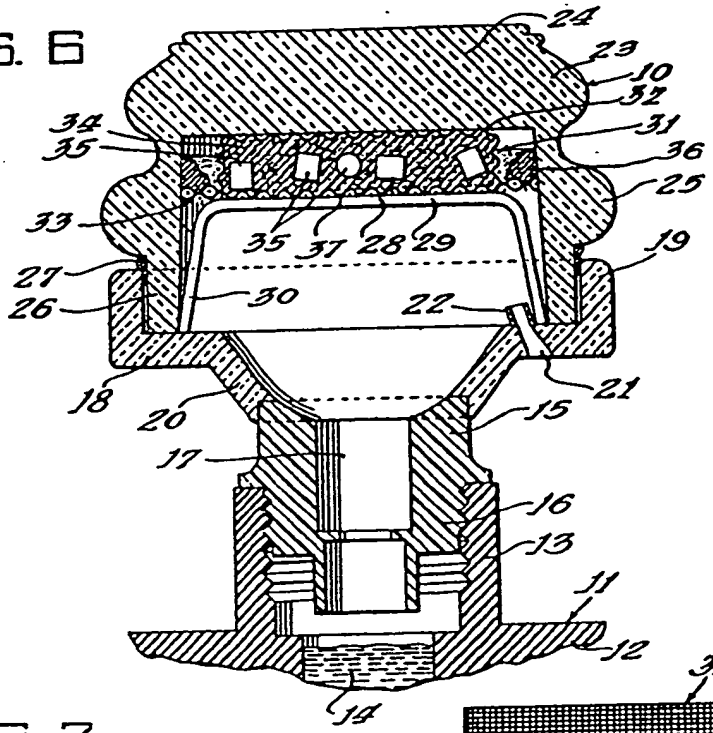
FIG. 6



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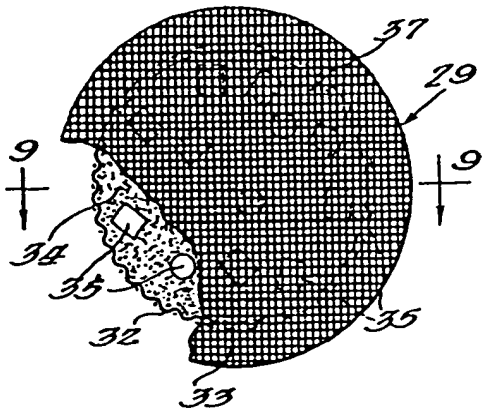


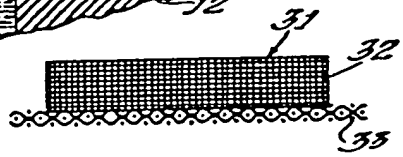
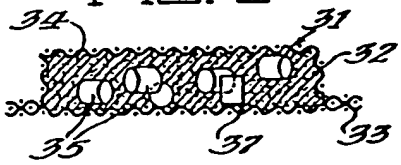


FIG. 8

FIG. 9



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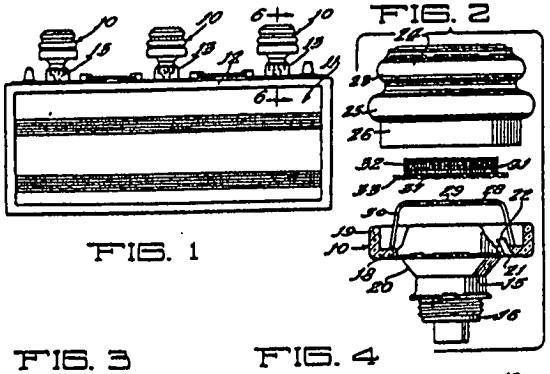

FIG. 1

FIG. 2

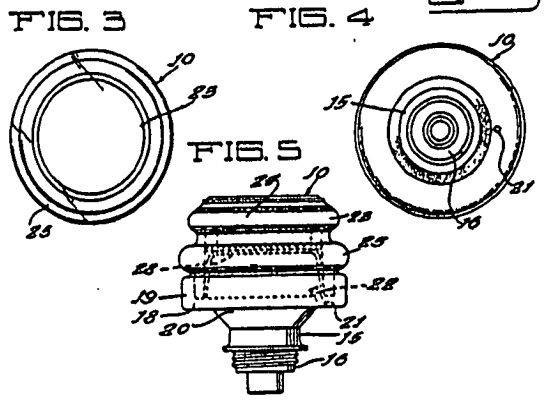

FIG. 3

FIG. 4

FIG. 5

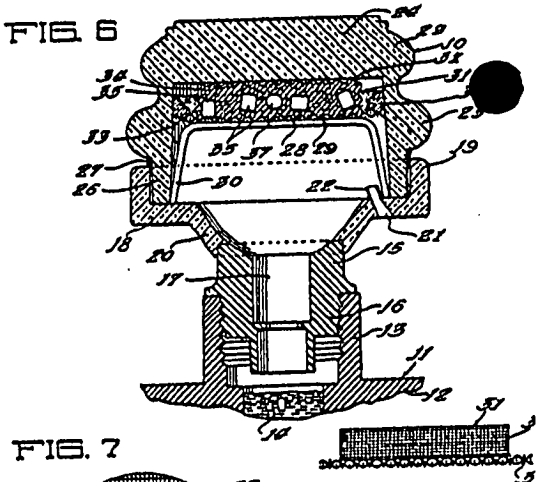

FIG. 6

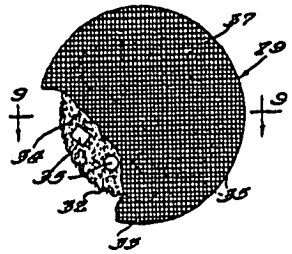

FIG. 7

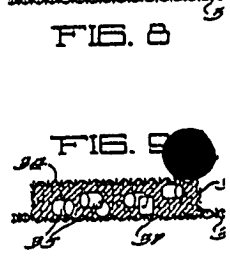

FIG. 8

FIG. 9